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THE UNITED STATES PATENT AND TRADEMARK OFFICE

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Applicants: S. TAKATANI et al
Serial No.: 10/073,240
Filed: February 13, 2002
For: SEMICONDUCTOR DEVICE AND FABRICATION
METHOD THEREOF
Group: 2811
Examiner: D. KANG

RESPONSE TO ELECTION REQUIREMENT

Commissioner for Patents
POB 1450
Alexandria, VA 22313-1450

July 28, 2003

Sir:

In reply to the outstanding Office Action, dated July 1, 2003, the following responsive remarks to the election requirement made are respectfully submitted in connection with the above-identified application.

The requirement made by the Examiner, namely, to elect a single disclosed species from the six (6) listed on page 2 of the Office Action is noted.

Accordingly, applicants, through their undersigned representative, provisionally elect species 2, relating to a capacitive structure such as described with regard to

Fig. 14 of the drawings and request examination therefor of claims 1-8, which are readable thereon. (Fig. 14 is described in the Specification in connection with the "Second Embodiment.")

It is respectfully requested, also, that species 3, which relates to the "Third Embodiment" in the Specification, having a capacitive structure such as shown in Fig. 16 of the drawings, be included (along with species 2) for purposes of examination noting that claims 1-8 of the present application are also readable thereon. Incidentally, at least claim 1, applicants submit, is considered a generic claim. Accordingly, if as a result of examination of the present application it is determined that claim 1 and/or any other claim that is considered a genus claim is allowable, examination of other ones of the listed species is also respectfully requested.

Regarding the provisionally elected species 2, the example capacitive structure shown in Fig. 14, which is provided on the semiconductor device layer 101, contains a PZT film 103 interposed between an upper electrode 104, which may be formed of Pt with an additive of Pb, although not limited thereto, and a lower electrode 102, which may be formed of Pt, although not limited thereto. The disclosed "Third Embodiment," which relates to the example showing of Fig. 16 of the drawings, likewise, contains a capacitive structure as that with regard to species 2 except for the type of material associated with the dielectric film. Namely, the "Second Embodiment" such as shown in Fig. 14 features a PZT film as the material for the dielectric film 103 while the "Third Embodiment," as shown in Fig. 16, uses a BST film as the dielectric material 301, although not limited thereto (see the discussion in the paragraph bridging pages 34 and 35 of the Specification. For these and other reasons and the fact that species 3 (relating to Fig. 16) is likewise readable on claims 1-8, grouping of species 3 in connection with the provisionally elected species II (relating to Fig. 14) for purposes of examination is respectfully requested therefor.

With regard to the alternative material for both the lower and upper capacitive electrodes, such as set forth in claims 4, 5 and 7, it is applicable to either of the embodiments pertaining to listed species 2 and 3 or, for that matter, with regard to other ones of the listed species, on page 2 of the outstanding election requirement. Both species 2 (which relates to Fig. 14) and species 3 (which relates to Fig. 16) feature a capacitor structure vertically stacked on a substrate which reduces the catalytic action resulting from the presence of the upper electrode metal into which impurities such as lead or other material metal, for example, are introduced, which has a deteriorating effect on the high-dielectric-constant or ferroelectric material of the capacitor. That is, a main concern regarding the present invention involves suppressing any deterioration of the capacitor due to the treatment thereof in a hydrogen atmosphere which is performed after the upper electrode of the capacitor is formed. Claims 1-8 cover such a scheme of which at least independent claims 1, 5 and 6 are genus claims to listed species 2 and 3 and can also be said to be generic to other ones of the listed species. In that regard, the following brief supportive discussion of the disclosed example embodiments relating to the species listed in the outstanding Office Action is being provided.

1. Fig. 13: The capacitor structure thereof contains a Pt lower electrode 74, a PZT film 75 and an IrO upper (plate) electrode 76 formed on a TiN plug 72 (see the description in the Specification relating to the Second Embodiment).

2. Fig. 14: The example shown features a capacitor structure having a PZT film 103 and a Pt upper electrode 104 with an additive of Pb formed on a Pt lower electrode 102 (see the description of the Third Embodiment in the Specification).

3. Fig. 16: The capacitor structure thereof features a BST film 301 and a Pt upper electrode 302 with an additive of Pb formed on a Pt lower electrode 102 (see the description of Fourth Embodiment in the Specification).

4. Fig. 18: The DRAM structure features a Pt lower electrode 1008, a BST film 1009 and a Pt upper electrode 1010 with an additive of Pb formed on a TiN plug 1007 (see the description of Fifth Embodiment in the Specification).

5. Fig. 19: The nonvolatile DRAM structure features a capacitor structure containing a TiN anti-reflection film 1101, a Pt lower electrode 1102, a PZT film 1103, Pt upper electrode 1104 with an additive of Pb, and a W film 1105 formed on a TiN plug 1007 (see the description of the Sixth Embodiment in the Specification).

As can be seen from the above example showings, although the component parts of the capacitor structures of Species 1, 4 and 5 (covering Figs. 13, 18 and 19) are not necessarily limited to that of the Species 2 (Fig. 14) and Species 3 (Fig. 16), a significant commonality is evident, nonetheless, between them. As a result, therefore, even though a technical case can be made for also dividing the claims, for example, on the basis of the various disclosed embodiments such as between

that called for in claims 1-8 with that of claims 9-22, a substantial amount of overlapping would necessarily be effected in connection with the proper state-of-the-art searching of claims directed to the different ones of the six named species. Accordingly, applicants, through their undersigned representative, urge the Examiner to include, also, claims 9-22 along with the claims 1-8 (directed to the provisionally elected species 2) for purposes of examination. According to U.S. practice and as set forth in MPEP §803:

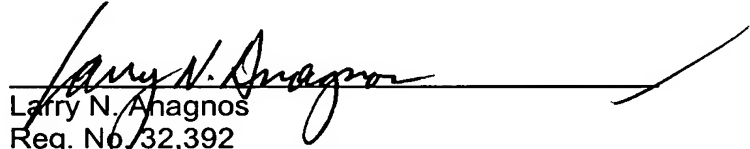
"[I]f the search and examination of an entire application can be made without serious burden, the Examiner must examine it on the merits, even though it includes claims to distinct or independent inventions."

Therefore, for the reasons noted hereinabove, examination of claims 1-8, which are readable on the provisionally elected species 2 and, also, on species 3 is respectfully requested. Should a genus claim (see claims 1, 5 and 6) become allowable, in due course, it is respectfully requested therefor that examination be made of all dependent claims thereto as well as any and all such claims that are readable on the presently non-elected species. Moreover, even if no genus claim is rendered allowable, due to the closeness of the subject matter involved including a substantial amount of overlapping therebetween, examination therefor of claims 9-22, in addition to that of claims 1-8, is respectfully requested.

To the extent necessary, applicants petition for an extension of time under 37 CFR §1.136. Please charge any shortage in the fees due in connection with

the filing of this paper, to the Deposit Account of Antonelli, Terry, Stout & Kraus, LLP, Dep. Acct. No. 01-2135 (520.37607VX1), and please credit any excess fees to such deposit account.

Respectfully submitted,
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